

PLASTIC PACKAGE WITH EXPOSED DIE AND METHOD OF MAKING SAME

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FIELD OF THE INVENTION

This invention relates to integrated circuit packages and in particular to molded plastic packages.

BACKGROUND OF THE INVENTION

Several surface mounted package types are currently in use, including plastic leaded chip carriers (PLCC), plastic quad flat packs, small outline packages and ball grid array (BGA) packages. Each package type supports an IC chip, or "die", and provides interconnections between the die and a printed circuit board (PCB).

FIG. 1 shows an example of a typical molded IC package 10. A lead frame 20 is the central supporting structure of the molded IC package 10 to which all other elements are attached. The lead frame 20 is etched or stamped from a thin metal strip to form a pattern of narrow leads 22 radially arranged around a central die attach platform 24 upon which a die 30 is mounted via an epoxy resin 40. The die 30 has a lower surface 32 contacting the epoxy resin 40 and an opposing upper surface 34 facing away from the die attach platform 24, and includes die bond pads 36 located on the upper surface 34. The die bond pads 36 are electrically connected to the leads 22 of the lead frame 20 by fine-diameter gold wires 50 using well established wire bond techniques. The lead frame 20, die 30 and wires 50 are covered with a thermoset plastic casing 60 using an operation called transfer molding. As indicated in FIG. 1, the plastic casing 60 includes an upper portion 62 formed over and contacting the upper surface 34 of the die 30, and a lower portion 64 formed under and contacting a lower surface 25 of the die attach platform 24. After transfer molding, leads 22 of lead frame 20 are plated, trimmed and formed to complete the molded IC package 10.

A problem with conventional molded IC package 10 is that, because the plastic casing 60 completely surrounds the die 30, heat dissipation from the die 30 is resisted. More specifically, the heat generated by the die 30 during normal operation must pass through the upper portion 62 of the plastic casing 60, and through the epoxy resin 40, die attach portion 24 and lower portion 64 of the plastic casing 60. Due to the insulating properties of the plastic casing 60, this heat dissipation is resisted, thereby creating, in some instances, high temperatures within the package 10 which can impair or damage the die 30.

A second problem is the physical size (thickness) of the conventional molded IC package 10. Specifically, the epoxy resin 40, die attach platform 24 and lower portion 62 of the plastic casing 60 substantially increase the overall thickness of the conventional molded IC package 10.

A third problem associated with the conventional molded IC package 10 is that the assembly process is complicated by the steps of applying the epoxy resin 40 onto the die attach platform 24, and then placing the die 30 onto the epoxy resin 40.

SUMMARY OF THE INVENTION

In accordance with the present invention, a plastic molded package is provided which incorporates a lead frame struc-

ture surrounding a die and encased by a plastic material, wherein a surface of the die and the lead frame are exposed through a molded plastic casing, thereby exposing the die for enhanced thermal performance. Further, the thickness of the inventive package is reduced when compared with the conventional plastic IC package (discussed above) because the inventive package eliminates the die attach pad and lower portion of the plastic casing which are used in the conventional package. Moreover, the inventive package is produced using a simplified assembly method in that the steps of applying epoxy resin and mounting the die on the die attach platform of the conventional package are eliminated.

In accordance with the present invention, the lead frame 15 of the plastic molded package includes plurality of leads extending radially away from the centrally-located die. The die has an upper surface which is electrically connected to an upper surface of the leads by wire bonding. A molded plastic casing is formed over the die, wiring and lead frame 20 to encapsulate the package. Lower surfaces of the die and lead frame are exposed through the plastic casing. To increase the heat transfer rate, the package may be mounted on a printed circuit board such that the die is mounted on a heat sink structure.

Also in accordance with the present invention, a method for producing a plastic molded package includes mounting a die and a lead frame on an adhesive tape such that the lead frame surrounds the die, wire bonding the die to the lead frame, forming a molded plastic casing over the die, wire bonding and lead frame, and, finally, removing the adhesive tape to expose a lower surface of the die and the lead frame.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of the present invention will become better understood with the following description, appended claims, and accompanying drawings where:

FIG. 1 shows a cross-sectional view of a conventional molded IC package;

FIGS. 2A and 2B are top and cross-sectional side views of a lead frame in accordance with an embodiment of the present invention;

FIG. 3 shows a cross-sectional side view of the lead frame mounted on an adhesive tape;

FIG. 4 shows a cross-sectional side view of a die mounted in a central opening of the lead frame;

FIG. 5 shows a cross-sectional side view of the die wire bonded to the lead frame;

FIG. 6 shows a cross-sectional view of a molded plastic casing formed over the assembly of FIG. 5; and

FIG. 7 is a section view of a plastic molded package in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 7 shows a section view of an electronic device 100 incorporating a plastic package formed in accordance with the present invention.

Referring to FIG. 7, the device 100 incorporates a substantially flat lead frame 110 having an upper (first) surface 112 and an opposite lower (second) surface 114. The lead frame 110 includes a plurality of radial leads 115 extending from a central opening 118. An integrated circuit die 120 is located in the central opening of the lead frame 110 such that